




City of Junction City, Kansas

Water and Wastewater Treatment Engineering Analysis and Pre-Design

February 17, 2014

HDR

Agenda

- Background
- Water Treatment Plant
  - Key Issues
  - Recommendations
  - Project Phasing and Costs
- East Wastewater Treatment Plant
  - Key Issues
  - Recommendations
  - Project Phasing and Costs
- Southwest Wastewater Treatment Plant
  - Key Issues
  - Recommendations
  - Project Phasing and Costs

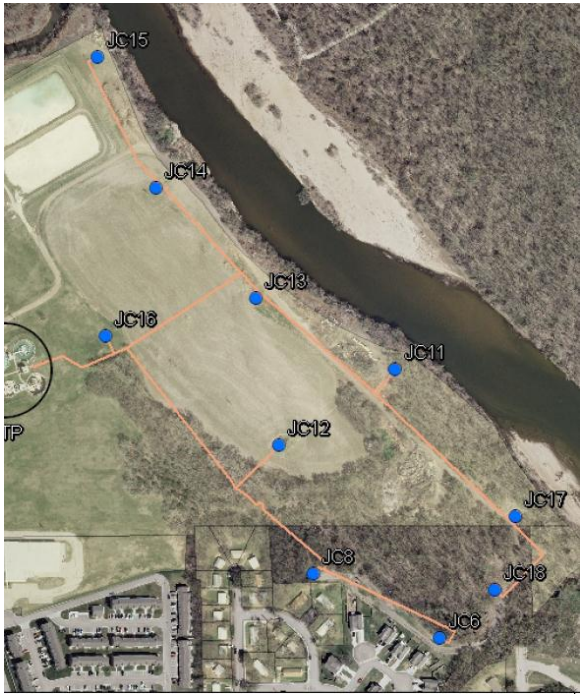
Background

- Water Treatment Plant
  - Constructed 1980
- East Wastewater Treatment Plant
  - Constructed 1954
  - Most recent upgrade 2000
- Southwest Wastewater Treatment Plant
  - Constructed 1996
  - Most Recent Upgrade 2006
  - Nutrient removal study completed February 2013
- Facility Contract Operations
  - November 1989 outsourced operations of Water and Wastewater
  - Amended and restated agreement June 2012 – Water and Wastewater Project

Water Treatment Plant

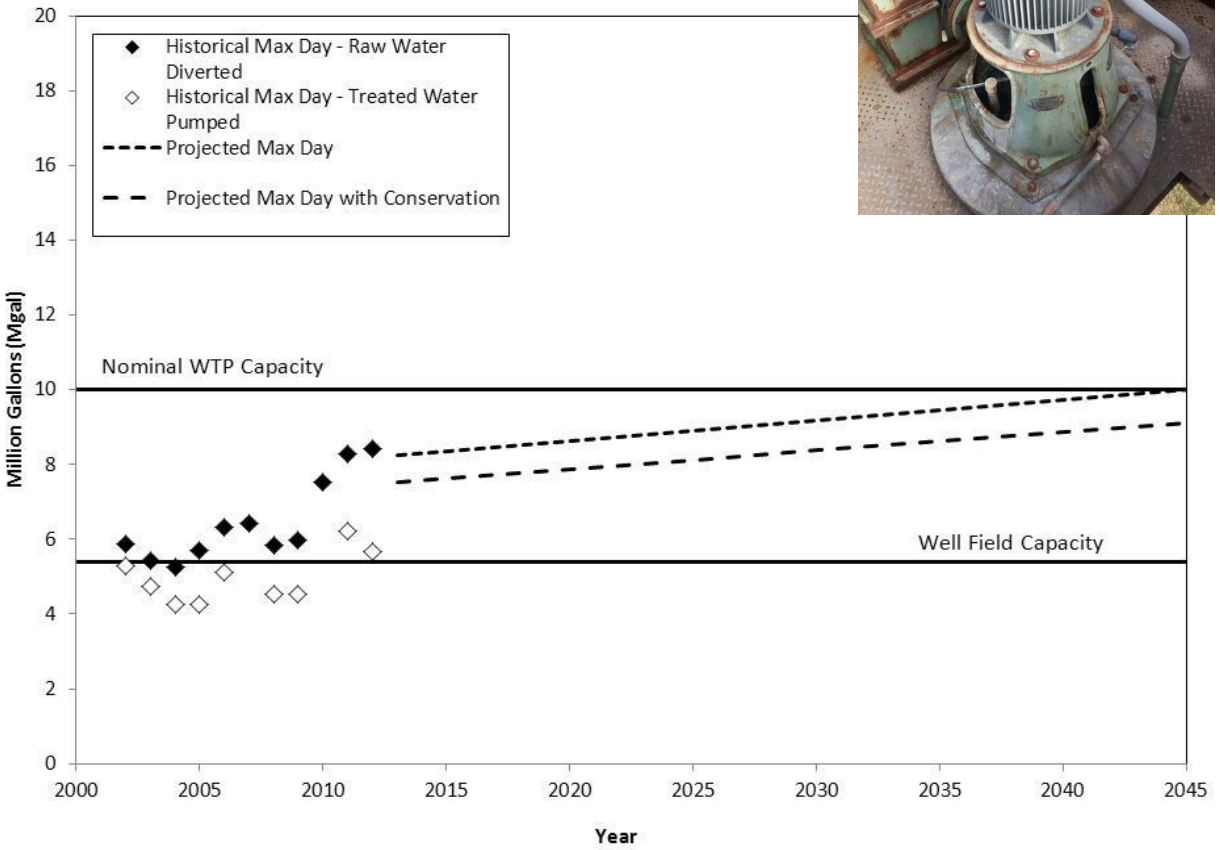
Key Issues – Water Use/Regulatory

- Overpumpage of Water Rights to Meet Demands
  - 2011: over by 7.5%; 2012: over by 9.9%
  - Penalties may be assessed by DWR
- High Unaccounted-For Water
  - 2012: 25.5%, typical: 10-15%
  - Existing old meters not measuring water use accurately
- Inaccuracies in Metering at Plant
  - Raw water meters
  - High and low service pumping meters



Key Issues – Water Supply

- Declining Well Field Capacity
  - Overpumpage of wells
  - Minimal well maintenance
    - Hydraulic limitations
  - Well 16 non-operational
  - Recent issues with Well 18



Key Issues – Water Treatment/Lime Softening

- Calcium Carbonate Deposition
  - Lack of stabilization/recarbonation
  - Deposition in piping, filters, hot water heaters, etc.
  - Hydraulic limitations
    - Plant piping
    - Distribution system
- Lime Sludge Lines Plugging
  - Large, gravity lime sludge piping plugs
  - Softening basins not operated as intended

Key Issues – Water Treatment/Clarification

- Non-Operational Chemical Equipment
  - Ferric sulfate, polymer
  - Overload filters with particulates

Key Issues – Water Treatment/Disinfection

- Safety of Chlorine Gas System
  - OSHA concern with chlorine gas piping
  - No means to close valves upon chlorine leak remotely
  - Manual switching from empty to full cylinders
- Disinfection By-Products
  - Stage 1 sample site in compliance but elevated
  - Stage 2 IDSE samples showed one remote site that was high
  - Stage 2 compliance began October 1, 2013

Key Issues – High and Low Service Pumping

- Service Issues
  - One low service pump out of service
  - Increased discharge pressure of pumps
    - Due to calcium carbonate deposition
  - 2400V MCC (medium voltage)
    - Disconnect switch unreliable
    - 30 years old – end of useful life
- Replacement Issues
  - Medium voltage (2400V) vs. low voltage (480V)
    - Low voltage reduces capital costs and maintenance
      - Pump motors, soft starts
      - Electrical switchgear, MCC
      - Eliminates transformers

Key Issues – Plant Finished Water Storage

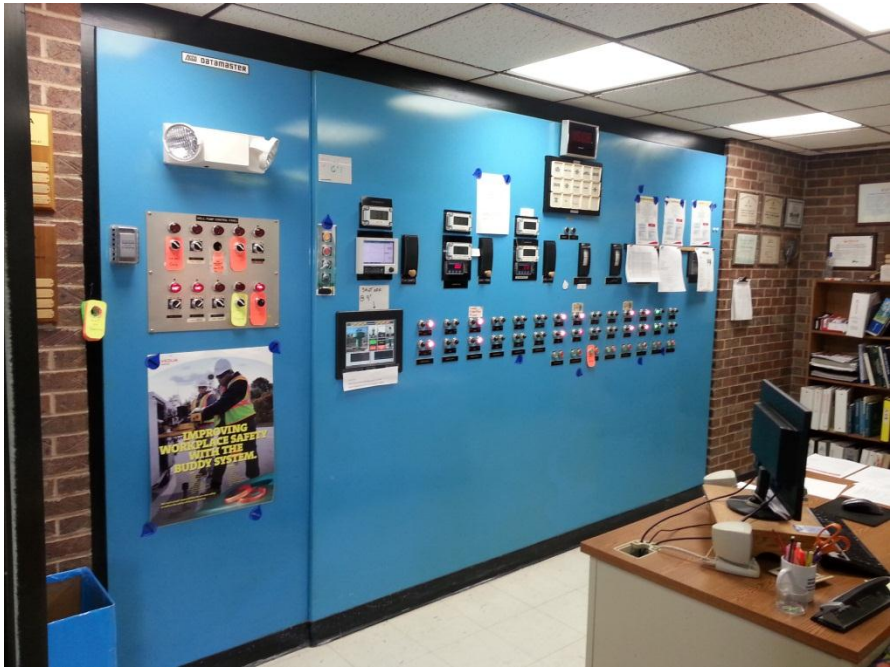
- Maintenance
  - Exterior paint peeling
    - Aesthetics for community
    - Preserve service life of steel
  - Lead paint
- No Redundancy
  - Maintaining tank is problematic
- Mixing
  - Improve turnover of tank contents

Key Issues – Electrical

- Main Switchgear
  - Main switch not operable
  - Cannot turn power off to plant
  - 15kV (high voltage) vs 480V (low voltage)
- Transformers
  - T-1, T-2
- No Back-Up Power
  - Plant and wells not operable during power outage

Key Issues – SCADA/Instrumentation

- No SCADA system
  - Limits productivity of staff / increased manpower
    - Well flow and water level read locally
    - Filter backwash manually initiated and ended
- Instrumentation
  - Existing phone line signal telemetry unreliable
    - Well #6, 11, 17 Controls



Key Issues – Maintenance

- Piping / Equipment Requires Painting
  - Wells, basin equipment, plant piping
- Building Roof
  - Roof leaks during rain storm
  - Plant staff mop up water or contain in buckets
- HVAC
  - Humidity control is an issue
  - Equipment beyond life expectancy
  - Lack of control within the building

Recommendations

- Water Use
  - Overpumpage of Water Rights to Meet Demands
    - Submit application to DWR for water rights through Water Assurance District
    - Implement water conservation rates
  - High Unaccounted-For Water
    - Replace customer meters
    - Install bulk water station
  - Inaccuracies in Plant Metering
    - Replace raw water meter
    - Replace high and low service meters
- Water Supply
  - Declining Well Field Capacity
    - Install a horizontal collector well
    - Implement well maintenance program for existing wells

Recommendations

- Water Treatment – Lime Softening
  - Calcium Carbonate Deposition
    - Install carbon dioxide feed for recarbonation
    - Clean basin weirs, downstream piping of deposition
  - Lime Sludge Lines Plugging
    - Install smaller lines to lagoons with cleanouts; use existing pump station
- Water Treatment - Clarification
  - Non-Operational Chemical Equipment
    - Install new ferric and polymer feed systems

Recommendations

- Water Treatment – Disinfection
  - Safety of Chlorine Gas System
    - Convert from pressure feed system to a vacuum feed system
    - Install automatic shut-off valves on ton cylinders
    - Install automatic switchover
  - Disinfection By-Products
    - Install liquid ammonium sulfate feed to convert secondary disinfection to chloramines

Recommendations

- Water Treatment – Low and High Service Pumping
  - Increased discharge pressure
    - Replace high and low service pumps with pumps capable of higher pressure
    - Install surge relief valves for water hammer
  - Electrical
    - Replace MCC – include soft starters for water hammer
    - Replace switchgear / abandon transformers
    - All work above at 480V (low voltage)
- Water Treatment – Plant Finished Water Storage
  - Historically minimal maintenance
    - Take the tank out of service and sandblast and paint the interior and exterior
  - Redundancy
    - Construct an additional finished water storage tank
  - Mixing
    - Install a mixing system inside the tank

Recommendations

- Water Treatment – Electrical
  - Main Switchgear / Transformers
    - Replace at 480V
    - Abandon transformers
  - Emergency Power
    - Install secondary power feed to plant and wells (in lieu of standby generation)
- Water Treatment – SCADA/Instrumentation
  - SCADA System
    - Install a plant SCADA system
  - Instrumentation
    - Replace well controls
    - Replace other instrumentation in the future upon failure to be compatible with SCADA

Recommendations

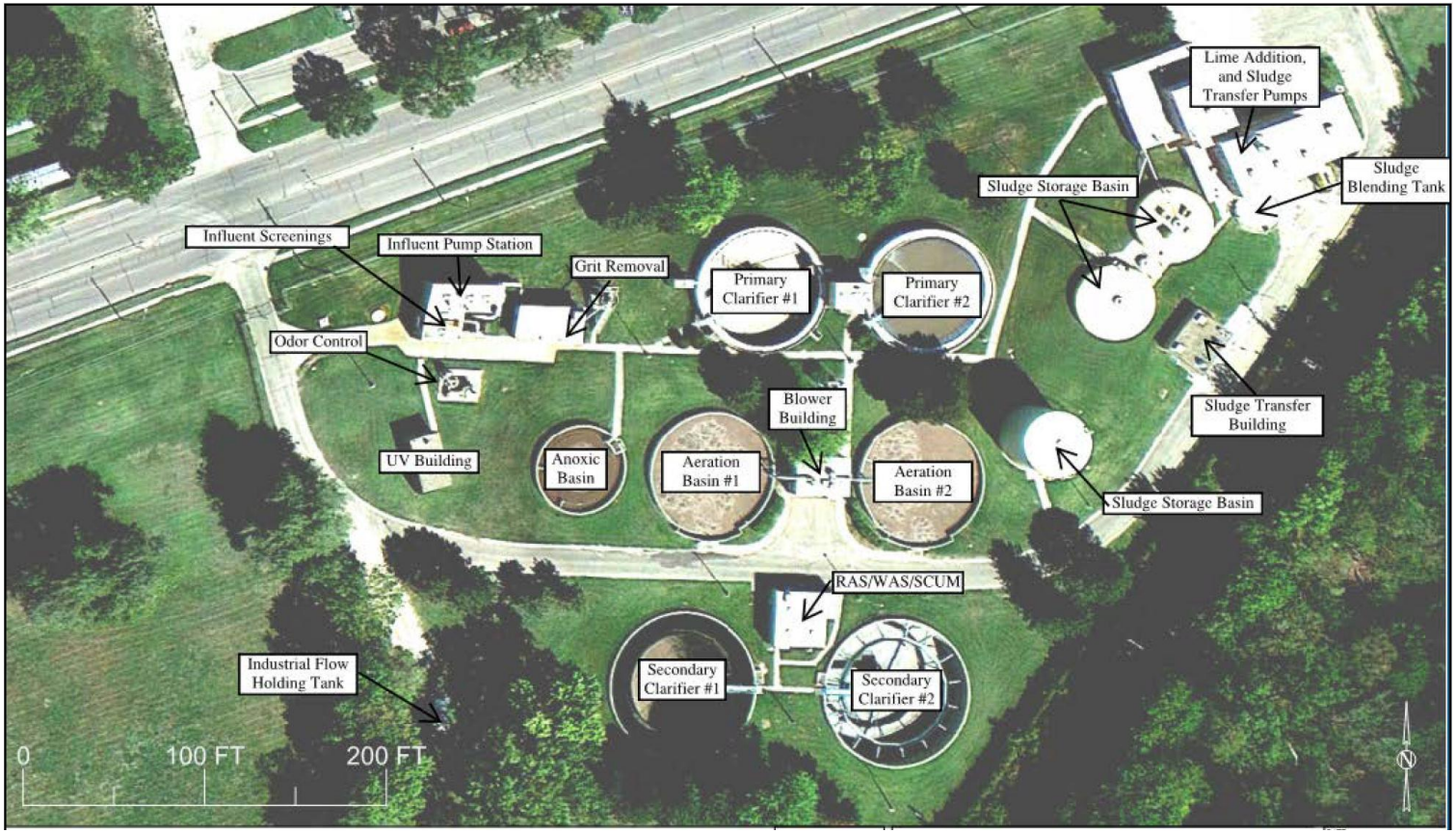
- Water Treatment – Maintenance
  - Piping / Equipment
    - Clean and paint exposed piping and equipment throughout plant including wells
  - Building Roof
    - Replace roof and skylights
  - HVAC
    - Replace HVAC equipment and controls
    - Install a dedicated air handling unit for the laboratory area
- Other Recommendations
    - Install a chlorine feed ahead of the aerators for periodic cleaning of the interior
    - Route lagoon decant to sanitary sewer instead of recycling to process
    - Install turbidimeters on individual filter effluent lines to monitor finished water quality and need for additional filtration capacity
    - Construct secondary containment for existing chemicals (current regulations)
    - Install a new gravel layer on well field access road

Project Prioritization

- Does not include distribution system piping
- Immediate Needs
  - Water rights application
  - Chlorine gas system improvements
- Other Projects
  - Phased according to:
    - Regulatory
    - Safety
    - Water quality
    - Capacity
    - Critical Asset
    - Reliability
    - Financial
    - Service Life
    - Productivity

	PROJECT		PHASE 1 (2014 - 2015)	PHASE 2 (2016 - 2017)	PHASE 3 (2019 - 2021)
1	Plant Raw Water Meter			$ 73,000	
2	High and Low Service Pipe Painting/Meters/Surge Valves			$ 110,000	
3	Horizontal Collector Well/Repair Well Controls (#6, 11, 17)		$ 3,762,000		
4	Recarbonation (Carbon Dioxide Feed)		$ 755,000		
5	Lime Sludge Improvements		$ 714,000		
6	Lime Sludge Decant to Sanitary Sewer			$ 20,000	
7	Liquid Ferric Sulfate Feed System			$ 812,000	
8	Liquid Polymer Feed System			$ 67,000	
9	Lime System Improvements		$ 77,000		
10	Fluoride Feed System		$ 67,000		
11	Chemical Containment		$ 18,000		
12	Filter Effluent Turbidimeters		$ 19,000		
13	Replace Filter Media				$ 164,000
14	Chloramines Conversion (Ammonia Feed)		$ 137,000		
15	Chlorine Gas Feed System Improvements		$ 63,000		
16	High and Low Service Pump Upgrades/Electrical		$ 763,000		
17	Replace Transfer Pumps				$ 173,000
18	Elevated Water Storage Tank in High Pressure Zone				$ 1,304,000
19	Ground Clearwell Improvements (Painting and Mixing)		$ 542,000		
20	Additional Ground Storage Clearwell				$ 1,344,000
21	Plant/Well Emergency Power		$ 210,000		
22	SCADA/Well Controls			$ 483,000	
23	Clean Piping and Basin Weirs of Deposition		$ 55,000		
24	Paint Plant Piping and Equipment			$ 60,000	
25	Replace Building Roof and Skylights		$ 271,000		
26	HVAC Improvements		$ 112,000	$ 91,000	
27	Re-Pave Plant Roadway				$ 208,000
28	Gravel Surface Well Field Roadway				$ 116,000
29	Bulk Water Station		$ 75,000		
	SUBTOTAL		$ 7,640,000	$ 1,716,000	$ 3,309,000
	Mobilization, Bonding and General Requirements	5.0%	$ 382,000	$ 86,000	$ 165,000
	Overhead and Profit	10.0%	$ 764,000	$ 172,000	$ 331,000
	SUBTOTAL		$ 8,786,000	$ 1,974,000	$ 3,805,000
	Contingency	25.0%	$ 2,197,000	$ 494,000	$ 951,000
	SUBTOTAL		$ 10,983,000	$ 2,468,000	$ 4,756,000
	Engineering, Legal, Administrative	20.0%	$ 2,197,000	$ 494,000	$ 951,000
	SUBTOTAL		$ 13,180,000	$ 2,962,000	$ 5,707,000
	Additional Projects (Not Subject to Markups)				
	Water Conservation Rates			$ 50,000	
	Customer Meter Replacements		$ 600,000	$ 1,200,000	
	Water Distribution System Sample Stations				$ 108,000
	Distribution System Tank Inspections		$ 80,000		
	Spruce Street Booster Pump Station Overhaul			$ 521,000	
	TOTAL		$ 13,860,000	$ 4,733,000	$ 5,815,000
	TOTAL (ALL PHASES)				$ 24,408,000

East Wastewater Treatment Plant



Key Issues – Preliminary & Primary Treatment

- Headworks
  - Gas Detection System Reliability Critical
  - Odor Control – Not Functional
  - Doors, HVAC, Electrical – Severely deteriorated
  - Fine Screens (Hand Rails, Grating) – Upgrade Required
  - Grit Removal - Air Lift Pump, Grit Building Doors, HVAC, Electrical
- Influent Pump Station
  - Wet Well Cover – Brittle and collapsed
- Primary Clarification
  - Primary Sludge Piping – End of Life
  - Splitter Structure – Uneven Distribution
  - Sludge Pumps, Grinders – End of Life

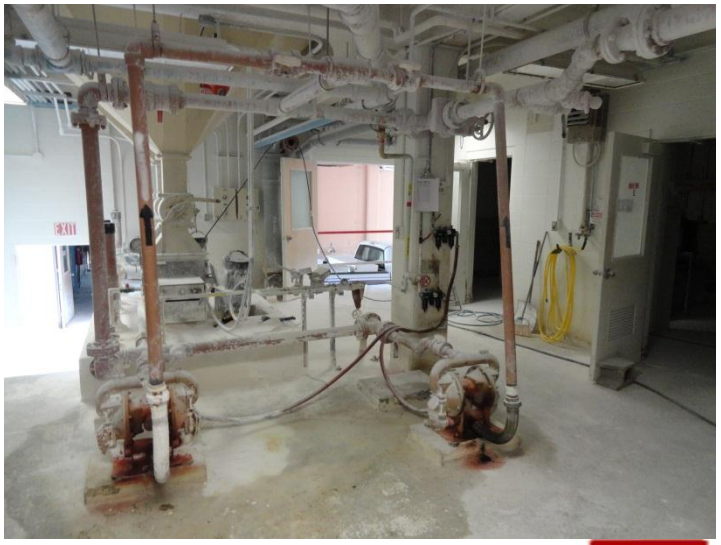
Key Issues – Secondary Treatment

- Activated Sludge
  - Blowers – End of Useful Life
  - Add Blower VFDs, Instrumentation & Controls – Facilitate Proper Process Control, Energy Savings
  - Aeration Diffuser System – Upgrade needed to support capacity
  - Anoxic Mixer – End of Useful Life
- Secondary Clarifiers
  - Rehabilitate Clarifiers – Mechanisms require replacement
    - One of two has been fixed to date
  - RAS Pumps, WAS Pumps, Scum Pump - Condition/End of Useful Life
  - Algae in clarifiers needs to be controlled

Key Issues – Biosolids

- Biosolids Treatment System
  - Blending Tank – Requires evaluation and recoating
  - Storage Tank – Requires evaluation and recoating; additional capacity needed
  - Sludge Transfer Pumps – Condition/End of Useful Life
  - Tank Blowers - Aged
  - Lime Feed System – End of Useful Life, Deteriorated
  - Lime Feed Room HVAC – Inadequate

Lime Feeder Room – Poor HVAC, deteriorated equipment



Key Issues – Nutrient Removal

- Tankage
  - Need additional zone - Anoxic Zone Required
- Recycle Pumping
  - Required to Support Nitrogen Removal
- Provide Chemical Feed Systems
  - Methanol Feed – Carbon source to facilitate denitrification
  - Alum Feed – Polishing step to meet phosphorus limits

Key Issues – SCADA/Instrumentation

- No SCADA system
  - Limits productivity of staff / increased manpower, efficiency of system, operations & maintenance costs increase
    - Alarm response time increased
    - Potential damage to equipment
- Instrumentation
  - Aeration System DO Control needed
    - Variable DO concentrations interfere with performance
      - Low DO results in inadequate nitrification
      - High DO wastes energy and can interfere with anoxic zone

Key Issues – Additional East WWTP Needs

- Site Needs
  - Laboratory - Small and Deteriorated
  - Locker Room - Small and Deteriorated
  - Pavement (Parking Lot, Walkways, and other deteriorated paved surfaces) - Aged

East WWTP Recommendations

- Maintenance Needs
  - Replace Preliminary Treatment Systems
  - Rehabilitate Headworks Building
  - Rehabilitate Primary Clarifier System
  - Rehabilitate Secondary Clarifier System
  - Replace Biosolids Equipment
  - Aeration System Diffusers and DO Control
- Capacity Needs
  - Install Additional Biosolids Storage Tanks

East WWTP Recommendations

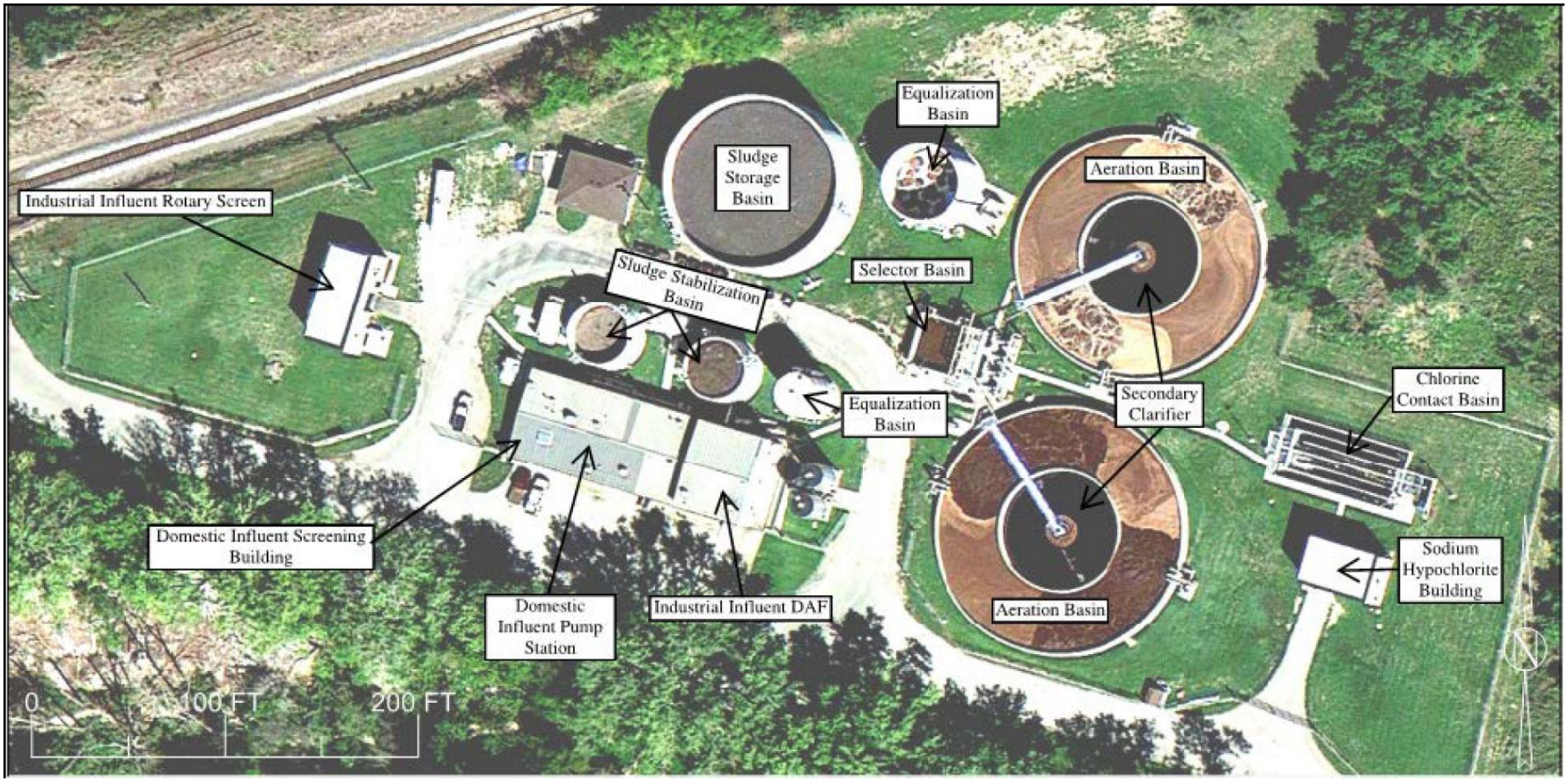
- Nutrient Removal Needs
  - Modify Existing Secondary Treatment Process
  - Chemical Feed Systems
- Other Recommendations
  - Install SCADA System
  - Remodel Locker Room, Laboratory
  - Replace deteriorated site paving
  - Replace/Upgrade Building HVAC, Electrical

East WWTP Project Prioritization

- Does not include any collection system improvements
- Immediate Needs
  - Replace gas detection/monitoring equipment in screening room
  - Replace failed clarifier bearing
- Other Projects
  - Phased according to:
    - Regulatory
    - Safety
    - Water quality
    - Capacity
    - Critical Asset
    - Reliability
    - Financial
    - Service Life

	FACILITIES		PHASE 1 (2014 - 2015)	PHASE 2 (2015 - 2017)	PHASE 3 (2019 - 2021)
1	INFLUENT PUMP STATION		$41,000	$0	$0
2	HEADWORKS BUILDING		$130,000	$706,000	$0
3	GRIT BUILDING		$45,000	$0	$0
4	PRIMARY CLARIFIERS		$420,000	$0	$0
5	PRIMARY SLUDGE PUMP STATION		$282,000	$0	$0
6	ANOXIC BASIN		$0	$47,000	$0
7	AERATION BASINS		$185,000	$266,000	$0
8	SECONDARY CLARIFIERS		$502,000	$0	$0
9	RAS/WAS PUMP STATION		$0	$235,000	$0
10	SLUDGE SYSTEM		$298,000	$344,000	$1,681,000
11	SITE		$475,000	$483,000	$0
12	BNR IMPROVEMENTS		$0	$0	$1,029,000
	SUBTOTAL		$2,378,000	$2,081,000	$2,710,000
	Mobilization, Bonding and General Requirements	5.0%	$119,000	$104,000	$136,000
	Overhead and Profit	10.0%	$238,000	$208,000	$271,000
	SUBTOTAL		$2,735,000	$2,393,000	$3,117,000
	Contingency	25.0%	$684,000	$598,000	$779,000
	SUBTOTAL		$3,419,000	$2,991,000	$3,896,000
	Engineering, Legal, Administrative	20.0%	$684,000	$598,000	$779,000
	TOTAL		$4,103,000	$3,589,000	$4,675,000
	TOTAL ALL PHASES				$12,367,000

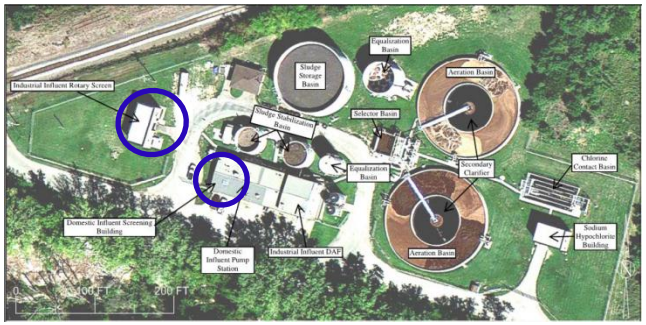
Southwest Wastewater Treatment Plant



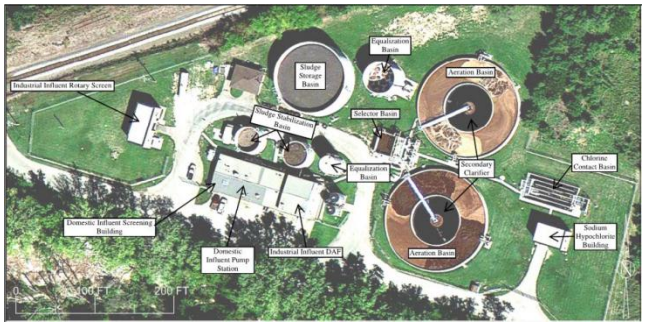
Key Issues – Preliminary & Primary Treatment

- Industrial Pretreatment
  - Rotary Screen Clogging and Solids Handling Issues
  - Rotary Screen – Single Point of Failure
  - pH Control Equipment Not Online
  - DAF Unit Inefficient and at End of Useful Life
  - DAF Building
    - HVAC, Lighting, Roof/Structure
- Domestic Pretreatment
  - Influent Pumps – End of Life
  - Influent Screen – Normal Wear

DAF Room – Deteriorated Ceiling, Poor Lighting, High Humidity, Extensive Heat Loss (HVAC), Aged DAF (Below)



Key Issues – Secondary Treatment

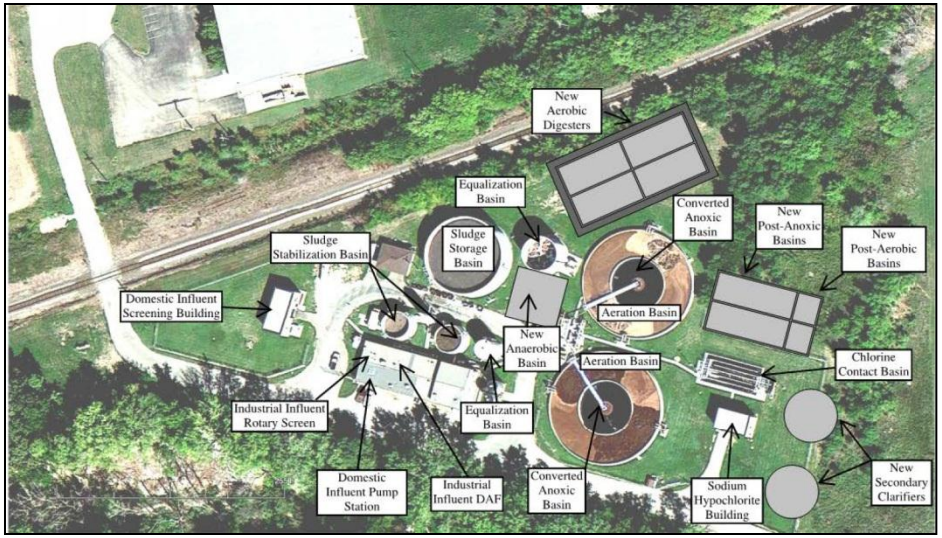


- Activated Sludge
  - Aeration System
    - Replace Leaky Piping, Replace Blowers, Replace and Update Instrumentation & Controls, Install Diffused Aeration
  - Anoxic Zone Mixers
- Secondary Clarifiers
  - Secondary Clarifiers – Mechanisms Worn
  - RAS Pumps, WAS Pumps, Scum Pump – End of Useful Life
- Disinfection
  - Chemical Feed Pumps – End of Useful Life

Aeration System – Leaky Piping, Jet Aeration Pump Limitations, Blower Failure

Key Issues – Biosolids & Nutrient Removal

- Biosolids Treatment System
  - Sludge Transfer Pumps – Worn and Deteriorated
  - Aerobic Digesters
    - Construct additional tankage and retrofit existing sludge storage tank
    - Install aeration systems in digesters and instrumentation and controls
- Nutrient Removal (BNR) Needs
  - Anaerobic Basin
  - Convert secondary clarifiers to anoxic basins
  - New secondary clarifiers
  - Chemical feed systems
    - Methanol and Alum Feed Needed
  - Recycle Systems
    - Pumps, Pipes, Electrical and Controls



Southwest WWTP Recommendations

- Maintenance Needs
  - Replace Industrial Pretreatment Systems
  - Replace Municipal Preliminary Treatment Systems
  - Rehabilitate Secondary Clarifier System
  - Replace pumps, blowers, and mixers
  - Replace Disinfection Chemical Feed Pumps
- Capacity Needs
  - Install Aeration System Diffusers and DO Control (Capacity and Maintenance Need)
  - Install Biosolids Treatment System

Southwest WWTP Recommendations

- BNR Needs
  - Modify Existing Secondary Treatment Process
    - Convert Secondary Clarifiers to Anoxic Zone, Install New Secondary Clarifiers
  - Install New Anaerobic Basin
  - Install Recycle Pumping System
  - Chemical Feed Systems
- Other Recommendations
  - Replace/Upgrade HVAC, Electrical in DAF Building

Southwest WWTP Project Prioritization

- Does not include any collection system improvements
- Immediate Needs
  - Replace sludge stabilization tank mixers
  - Replace 1 WAS Pump
  - Replace 2 influent pumps
  - Replace DAF recycle pumps
  - Replace chlorine dosing pumps
  - Replace gas detection/monitoring equipment and room lighting in domestic screening room
  - Replace room lighting in industrial screening room
  - Replace water boiler for rotary screen
- Other Projects
  - Phased according to:
    - Regulatory
    - Safety
    - Water quality
    - Capacity
    - Critical Asset
    - Reliability
    - Financial
    - Service Life

	FACILITIES		Phase 1 (2014 - 2015)	2 (2015 - 2017)	3 (2019 - 2021)
1	FLOW DIVERSION STRUCTURE		$41,000	$0	$0
2	SCREENING - INDUSTRIAL AND DOMESTIC		$163,000	$153,000	$0
3	ACID FEED SYSTEM		$20,000	$0	$0
4	EQUALIZATION BASINS		$0	$169,000	$0
5	DISSOLVED AIR FLOTATION		$557,000	$0	$0
6	BNR		$0	$0	$3,843,000
7	SELECTOR BASIN		$0	$46,000	$0
8	AERATION SYSTEM		$899,000	$0	$0
9	SECONDARY CLARIFIERS		$3,083,000	$0	$0
10	WAS/RAS/SCUM		$41,000	$16,000	$0
11	SLUDGE SYSTEM		$0	$6,175,000	$0
	SUBTOTAL		**$4,804,000**	**$6,559,000**	**$3,843,000**
	Mobilization, Bonding and General Requirements	5.0%	$240,000	$328,000	$192,000
	Overhead and Profit	10.0%	$480,000	$656,000	$384,000
	SUBTOTAL		$5,524,000	$7,543,000	$4,419,000
	Contingency	25.0%	$1,381,000	$1,886,000	$1,105,000
	SUBTOTAL		$6,905,000	$9,429,000	$5,524,000
	Engineering, Legal, Administrative	20.0%	$1,381,000	$1,886,000	$1,105,000
	TOTAL		$8,286,000	$11,315,000	$6,629,000
	TOTAL ALL PHASES				$26,230,000

Next Steps

- Water and Sewer Rate Analysis
  - Revenue Bonds
  - Low-interest Loan
  - Grants
- Discussions with Armour Eckridge to understand their future needs

Questions